REMARKS / ARGUMENTS

The Examiner rejected claims 1-3, 13-14 and 21-22 under 35 U.S.C. Section 102(e) as being anticipated by Nagai et al., US 2002/013553 A1.

Nagai et al. disclose an image display projection system that includes a light emitting diode array 61, a light source driving circuit 52 interconnected to the light emitting diode array 61, a reflection type liquid crystal display 67, and a liquid crystal display driving circuit 55 interconnected to the liquid crystal display 67.

Nagai et al. teach at paragraph 0122 that the liquid crystal is specifically operated in a binary on/off nature as follows:

> [The liquid] crystal on-off gradation control system (lighting period control system) is described in the present Embodiment. It is a feature of the system that digital gradation control is performed by on-off (PWM: Pulse Width Modulation) of the liquid crystal (LCD). Namely, the luminance is controlled by modulating a pulse width based only on the operation of on or off of the liquid crystal. In the conventional LCD, the gradation is controlled in analog by utilizing (gamma) feature (relational curve between a transmittance and an applied voltage). Though it is easy to control the gradation in the range where the relation between the transmittance and the applied voltage is expressed by a direct line (linear), the control performance is decreased and becomes unstable in the nonlinear range (where the transmittance is close to 1 or 0) which is a disadvantage of the analog control.

Nagai et al. further disclose that the transistors of the liquid crystal display have "only function of on-off, and analog data is supplied from the external driving circuit and stored in the capacitor provided per pixel." See, Paragraph, 0127.

Accordingly, Nagai et al. specifically disclose that the liquid crystal display is only capable of a binary on-off operation.

Further, Nagai et al. specifically teach that the use of an "analog" liquid crystal display is an entirely undesirable function in combination with a variable light emitting diode backlight. The following excerpts from Nagai et al. state such an undesirability with absolute clarity:

> [0127] In the current TFT liquid crystal display, the transistor used for a pixel switch has an only function of on-off, and analog data is supplied from the external driving circuit and stored in the capacitor provided per pixel.
>
> [0128] If a TFT liquid crystal display of driving circuit unified type is formed by using the low temperature p-Si TFT obtained from a polycrystal based on the laser annealing, it is difficult to obtain an analog voltage output of high accuracy from the driving circuit, because other transistor feature (threshold voltage, electron mobility) is not uniform. Since an error is generated in the output voltage of each analog circuit, a luminance difference is generated between the length lines or between the display area blocks, which causes an irregular display (uneven luminance).
>
> [0129] Besides the current analog gradation control has a problem of unevenness of the gamma curve (transmittance-voltage feature) of each liquid crystal pixel or unevenness per manufacturing. Especially, there is a problem of the gradation control for an intermediate tone. Also, there is a problem that an adjusting operation is needed per manufacturing. Further in the case of the low temperature p-Si TFT AMD, the stated problem that the feature of the TFT-LCD driving circuit unified type is not even is added to the above problems, which becomes a critical problem. In order to eliminate the above unevenness, it is necessary to strictly

control the device features. To eliminate the above problems is a large target to be overcome in the manufacturing process, but it is impossible to perfectly solve these problems.

[0130] The on-off digital gradation control is very effective in solving or easing the above problems. It is just enough for the optical switch to have an only function of on (transmission) and off (cut off). For instance, even when the signal voltage is uneven or the γ feature of each pixel is uneven, it is adequate enough to supply the voltage to be applied for the range of on or off of the LCD. Namely, displaying which is difficult to influence by the device features can be performed.

Accordingly, Nagai et al. specifically teach that it is undesirable to use an analog liquid crystal display in combination with a variable light emitting diode backlight. This teaching of Nagai et al. is further exemplified by Figure 18 which suggests that the emission of the light emitting diode can have a fixed time, a variable time, a fixed intensity, or a variable intensity while the liquid crystal panel always has a binary functionality of on/off consistent with the teaching of Nagai et al.

Claim 1 patentably distinguishes over Nagai et al. by claiming a method of illuminating a backlit display, where the method comprises the step of varying a luminance of a light source illuminating a displayed pixel in response to an intensity value of the pixel and varying the transmittance of a light valve of the display in a non-binary manner.

As previously noted Nagai et al. specifically teach the non-desirability of varying the transmittance of the liquid crystal panel in a non-binary manner (e.g., on/off) together with varying the luminance of a light source. Further, there would be no motivation to combine Nagai et al. with other references to vary the transmittance of the light valve since Nagai et al. specifically teach the undesirability of such a design.

It is noted that the claimed combination of a non-binary light valve and a variable light source provides an increased bit depth for the displayed image over that of the variable light source itself. The extra bit-depth obtained by such a combination is especially useful when displaying images on a display with an increased dynamic range. Accordingly, the increased bit depth achieved through the unique claimed combination enables improved displaying of images on a display that has an increased dynamic range. Further, Nagai et al. fail to appreciate any potential synergy obtainable from the combination of both a non-binary light valve and a variable light source.

Claims 2-14 depend from claim 1, either directly or indirectly, and are patentable for the same reasons asserted for claim 1.

Claim 15 patentably distinguishes over Nagai et al. by claiming a method of illuminating a backlit display, where the method comprises the step of illuminating the light element according to a relationship of the maximum of the filtered luminance and the statistical value of the filtered luminance and varying the transmittance of a light valve of the display in a non-binary manner.

As previously noted Nagai et al. specifically teach the non-desirability of varying the transmittance of the liquid crystal panel in a non-binary manner (e.g., on/off) together with varying the luminance of a light source. Further, there would be no motivation to combine Nagai et al. with other references to vary the transmittance of the light valve since Nagai et al. specifically teach the undesirability of such a design.

Claims 16-18 depend from claim 15, either directly or indirectly, and are patentable for the same reasons asserted for claim 15.

Claim 19 patentably distinguishes over Nagai et al. by claiming a backlit display comprising a luminance output of a light source and a light valve arranged for non-binary locally modulated transmittance of light from the light source elements, and the locally modulated transmittance being responsive to a data value of an image pixel.

As previously noted Nagai et al. specifically teach the non-desirability of varying the transmittance of the liquid crystal panel in a non-binary manner (e.g., on/off) together with varying the luminance of a light source. Further, there would be no motivation to combine Nagai et al. with other references to vary the transmittance of the light valve since Nagai et al. specifically teaches the undesirability of such a design.

Claim 20 depends from claim 19, and is patentable for the same reasons asserted for claim 19.

Claim 21 patentably distinguishes over Nagai et al. by claiming a backlit display with a variable light source, and a light valve varying the transmittance of light from the display in a non-binary manner.

As previously noted Nagai et al. specifically teach the non-desirability of varying the transmittance of the liquid crystal panel in a non-binary manner (e.g., on/off) together with varying the luminance of a light source. Further, there would be no motivation to combine Nagai et al. with other references to vary the transmittance of the light valve since Nagai et al. specifically teach the undesirability of such a design.

Claim 22 depends from claim 21, and is patentable for the same reasons asserted for claim 21.

If the Examiner believes that for any reason direct contact with applicant's attorney would advance the prosecution of this application, the Examiner is invited to telephone the undersigned at the number below.

Respectfully submitted,
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